Fig.1

Fig.2

Fig.3

	Cn0	Cn1	Cn2	Cn3	
	BYTES 15:0	BYTES 16:31	BYTES 32:47	BYTES 48:63	C-CHANNEL
LOCKED AND SYNC TO EACH OTHER	OPCODE	BCST BIT MAP	UNTAGGED BITMAP	TIME-STAMP	P-CHANNEL
					S-CHANNEL

SECTION B

SECTION A

Fig.4a

1 CELL_
CYCLE

Fig.4b

Fig.5

PROTOCOL CHANNEL MESSAGES

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
OP CODE	IPP IPX	RESERVED	NXT CELL	SRC DEST PORT			COS	J	S	E	CRC	P		LEN	
											0				

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
RESERVED								BC/MC PORTBITMAP							

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
U	RES				UNTAGGED PORTBITMAP/SRC PORT NUMBER (BIT0..5)										

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
CPU OPCODES								TIME STAMP							

Fig.6

SIDE BAND CHANNEL MESSAGES

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
OPCODE			DEST PORT / DESTINATION DEV ID			SRC PORT			DATA LEN			E	E CODE	COS	C
ADDRESS															
DATA															

Fig.7

PRIOR ART

LAYER SEVEN-APPLICATION
LAYER SIX-PRESENTATION
LAYER FIVE-SESSION
LAYER FOUR-TRANSPORT
LAYER THREE-NETWORK
LAYER TWO-DATA LINK
LAYER ONE-PHYSICAL
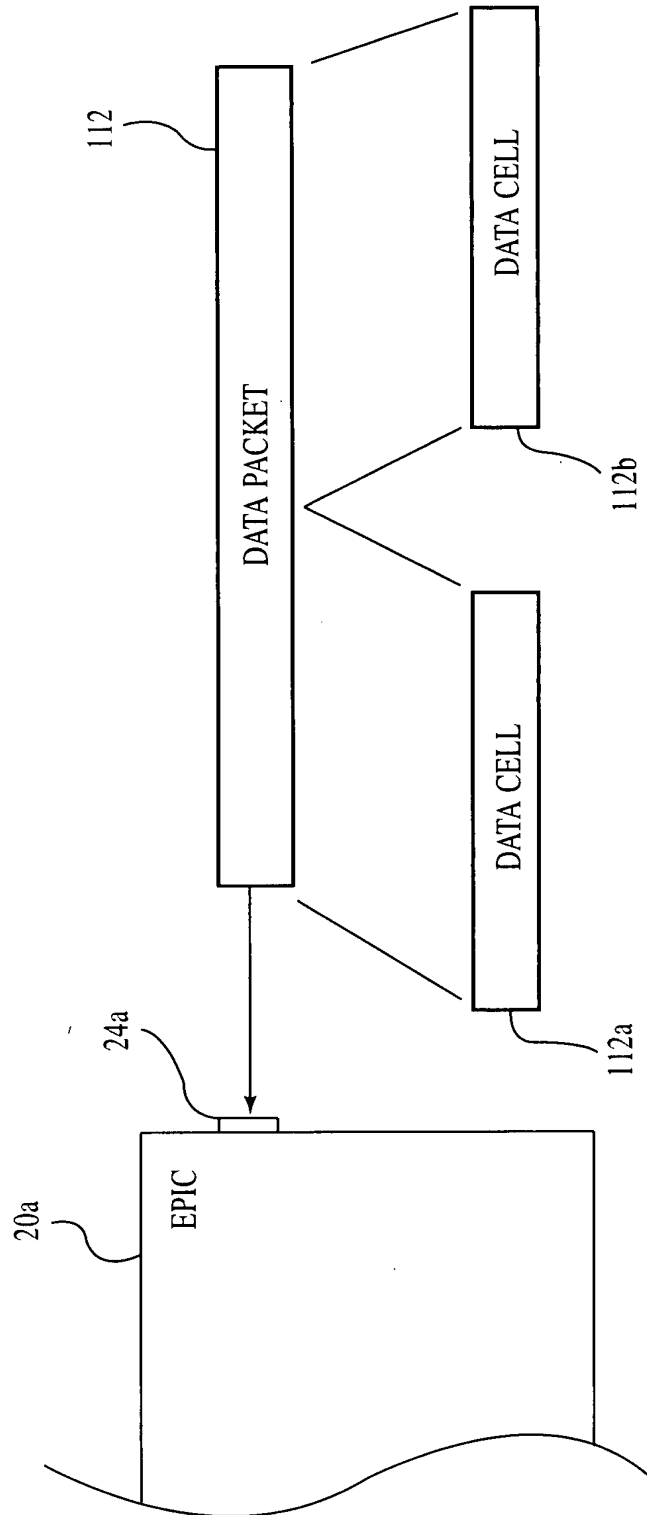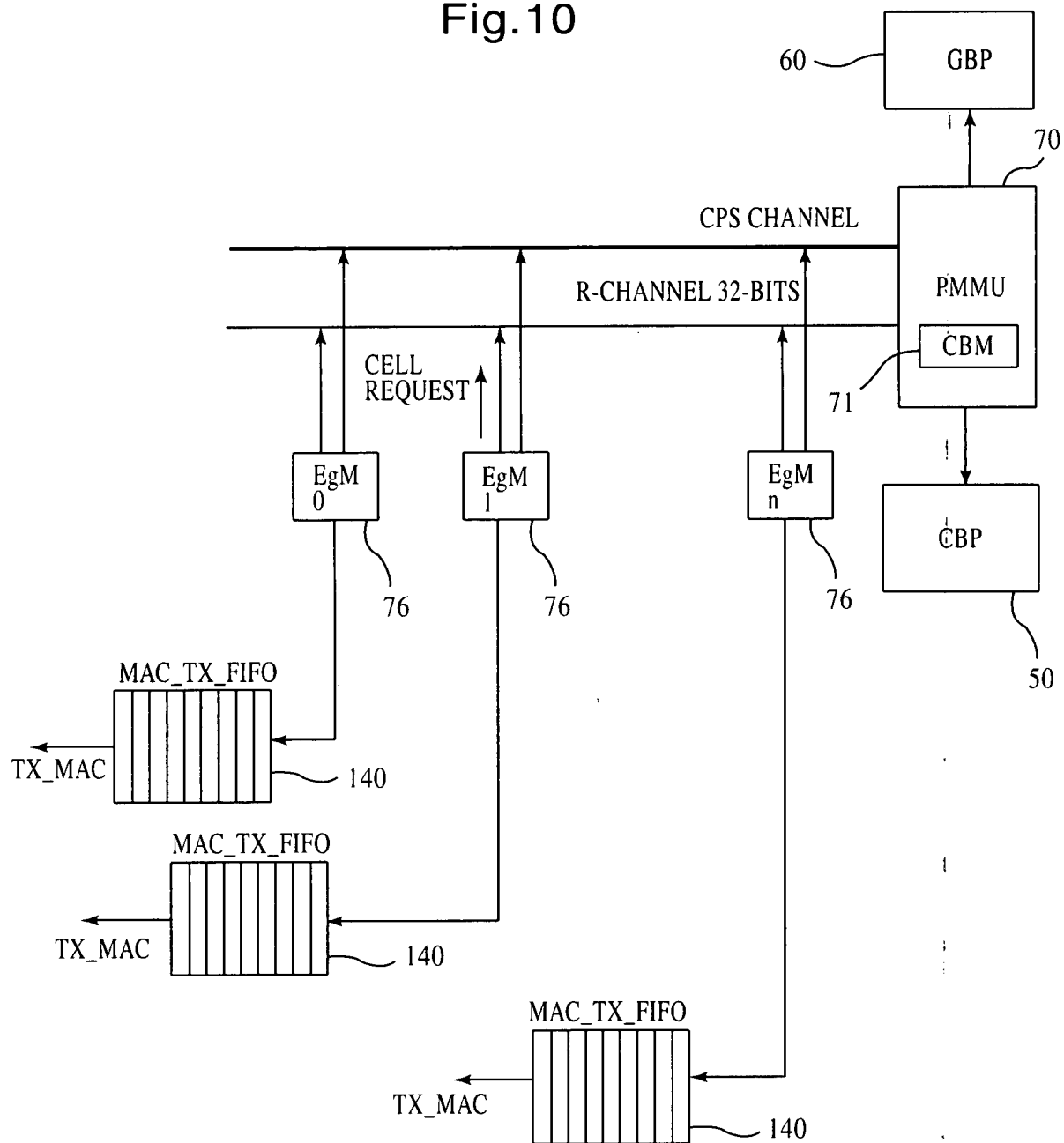
Fig.8

EPIC 20a

DATA PACKET — 112

24a

INGRESS SUBMODULE 14a

EGRESS SUBMODULE 16a

DISPATCH UNIT 18a

C CHANNEL 81

P CHANNEL 82

S CHANNEL 83

ARL & L3 TABLES 21a

RULES TABLE 22a

VLAN TABLE 23a

Fig.9

DATA PACKET

112

112b

DATA CELL

112a

DATA CELL

24a

20a

EPIC

Fig.10

60 — GBP

70

CPS CHANNEL

R-CHANNEL 32-BITS

PMMU

CBM

CELL
REQUEST

71

EgM
0

EgM
1

EgM
n

CBP

76   76   76

50

MAC_TX_FIFO

TX_MAC

140

MAC_TX_FIFO

TX_MAC

140

MAC_TX_FIFO

TX_MAC

140

Fig.11

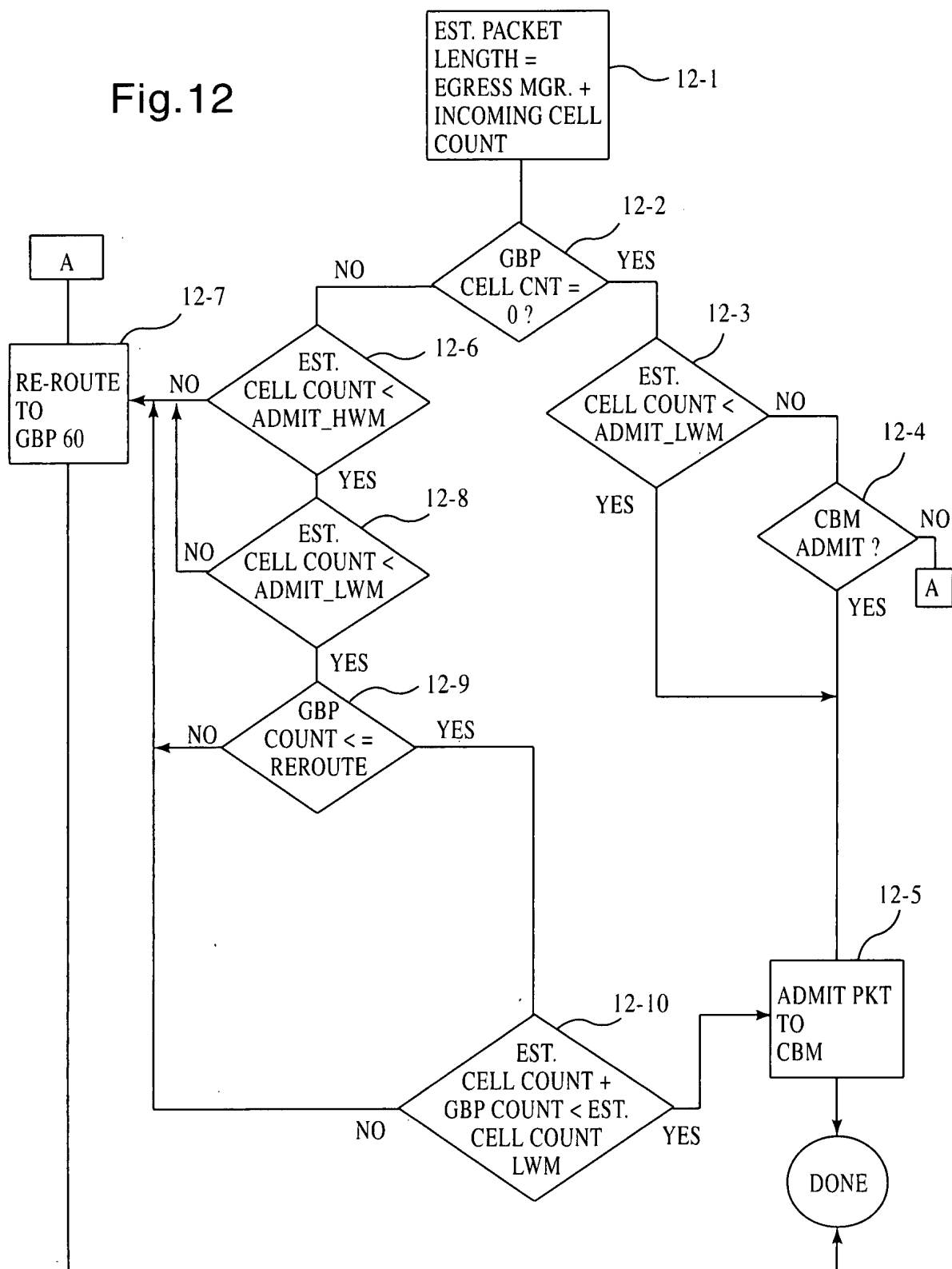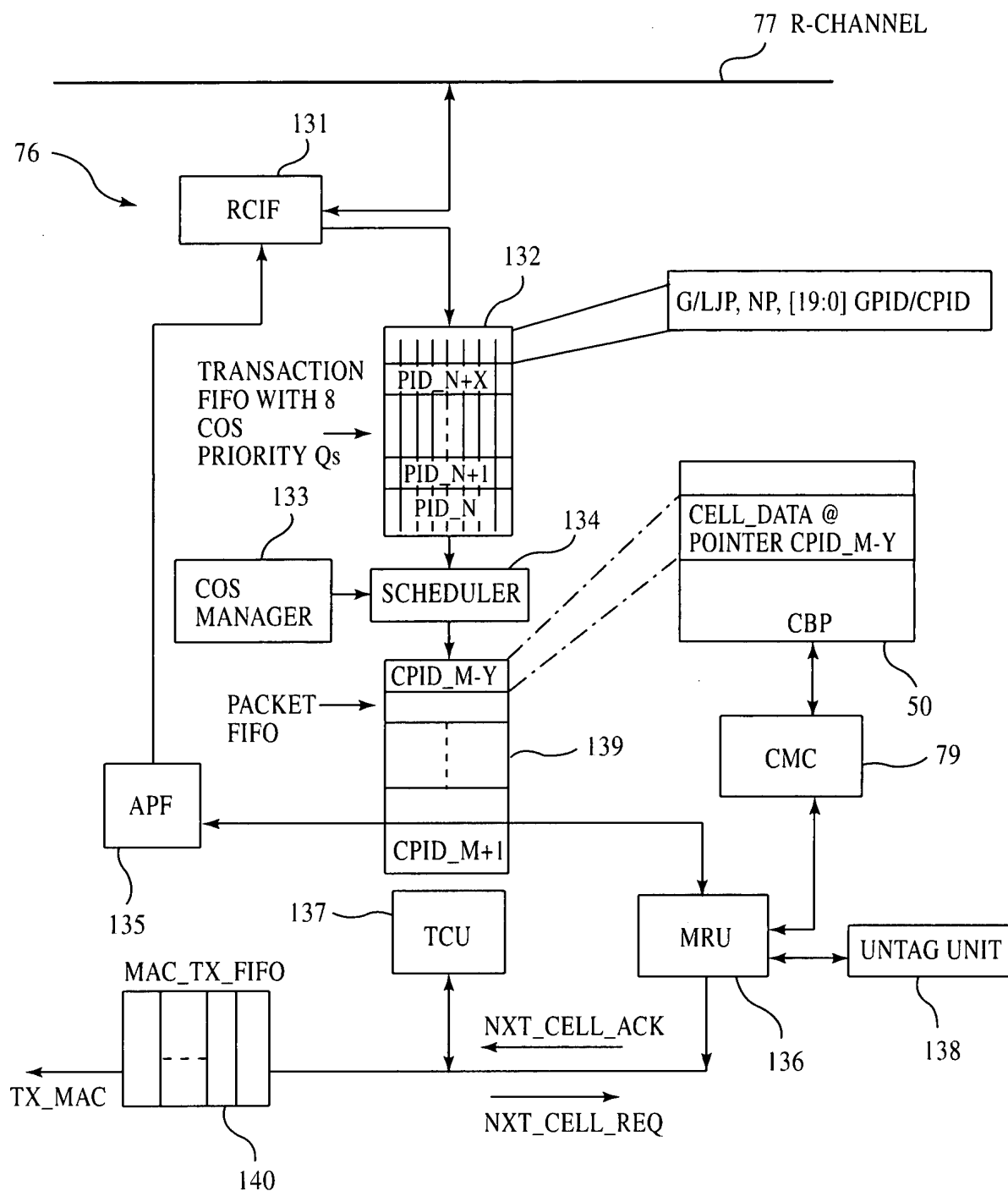|	
LINE 0 →	FC I LC I BC/MC I Cpy_cnt (5b) I Cell_length (7b) I CRC (2b) I NC_header (16b) I Src Count (6) I IPX I IP I I Time_Stamp (14b) I O bits (2b) I P I NextCellLen(2b) I CpuOpcode(4b) I Cell_data (0-9B)
LINE 1 →	Cell_data (10-27) Bytes
LINE 2 →	Cell_data (28-45) Bytes
LINE 3 →	Cell_data (46-63) Bytes

Fig.12

```
                        ┌─────────────────┐
                        │ EST. PACKET     │
                        │ LENGTH =        │
                        │ EGRESS MGR. +   │── 12-1
                        │ INCOMING CELL   │
                        │ COUNT           │
                        └─────────────────┘
                                 │
                        ┌───────────────┐  12-2
                   NO   ╱   GBP         ╲   YES
              ┌────────<   CELL CNT =    >────────┐
              │         ╲     0 ?       ╱         │
              │          └───────────────┘        │
              │                                    │
   12-7       │       12-6                         │   12-3
              │    ┌───────────────┐            ┌───────────────┐
┌──────────┐  │ NO ╱    EST.       ╲         NO ╱    EST.       ╲   NO
│ A        │  │<──<  CELL COUNT <   >         <  CELL COUNT <    >────┐
└──────────┘  │    ╲  ADMIT_HWM    ╱          ╲  ADMIT_LWM    ╱       │
    │         │     └──────┬───────┘            └──────┬──────┘    12-4
┌──────────┐  │            │ YES                       │ YES   ┌──────────┐
│ RE-ROUTE │  │       ┌───────────────┐  12-8          │    NO ╱  CBM     ╲ NO
│ TO       │<─┘    NO ╱    EST.        ╲               │      <   ADMIT ?  >──┐
│ GBP 60   │<──────<  CELL COUNT <     >              │       ╲           ╱   │
└──────────┘        ╲  ADMIT_LWM     ╱                │        └────┬─────┘ ┌───┐
                     └──────┬────────┘                │         YES │       │ A │
                            │ YES                     │             │       └───┘
                       ┌───────────────┐  12-9        │             │
                    NO ╱    GBP         ╲  YES         │             │
              ┌───────<  COUNT < =       >─────┐       │             │
              │        ╲  REROUTE       ╱      │       │             │
              │         └───────────────┘      │       │             │
              │                                │       │             │
              │                                │       │             │
              │                                │                     │
              │                                │   12-10             │
              │        ┌──────────────────┐              ┌─────────┐
              │        ╱    EST.           ╲     12-5     │ ADMIT   │
              │     NO ╱  CELL COUNT +      ╲  YES         │ PKT     │
              └──────<   GBP COUNT < EST.    >──────────> │ TO      │
                      ╲  CELL COUNT        ╱              │ CBM     │
                       ╲   LWM            ╱               └─────────┘
                        └────────────────┘                    │
                                                          ┌────────┐
                                                          │  DONE  │
                                                          └────────┘
```

Fig.13

77 R-CHANNEL

131

76

RCIF

132

G/LJP, NP, [19:0] GPID/CPID

TRANSACTION
FIFO WITH 8
COS
PRIORITY Qs

PID_N+X

PID_N+1
PID_N

133

CELL_DATA @
POINTER CPID_M-Y

COS
MANAGER

SCHEDULER

134

CBP

CPID_M-Y

PACKET
FIFO

139

50

APF

CMC

79

CPID_M+1

135

137

TCU

MRU

MAC_TX_FIFO

NXT_CELL_ACK

UNTAG UNIT

TX_MAC

NXT_CELL_REQ

136

138

140

Fig.14

DATA FLOW

112

20

24

142

INPUT FIFO

232

PORT BASED VLAN TABLE

231

802.1q TAGGED VLAN TABLE

143

ARL ENGINE (L2/L3 SEARCH ENGINE)

ARL TABLE + L3 TABLE

21

141

FFP

RULES TABLE

22

18

DISPATCH UNIT

BUFFER SLICER

144

81 — C_CHNL

82 — P_CHNL

83 — S_CHNL

Fig.15

FROM INPUT
FIFO

141

1411

1410

LOGIC ◄─────► FILTER
MASKS

TO RULES
TABLE

Fig.16

40

PCI
BUS

I2C
BUS

42

I2C CORE

41

PCI CORE

167

ADDRESS
16

DATA
32

PIO/SLAVE
ADDRESS

ADDRESS
32

42a

DATA
32

MASTER
ADDRESS

MASTER
DATA

PIO/SLAVE DATA

I2C SLAVE
I/F

I2C MASTER
I/F

42b

161

DMA
CONTROL

PIO REGISTERS

168

MIIM
I/F

169

162

CP-CHANNEL
BUFFERS

SCH PIO
REGISTERS

166

SCH ARL MSG
BUFFERS

165

CP-BUS I/F

163

164

SCH BUS I/F

C-CHANNEL 81
P-CHANNEL 82

S-CHANNEL 83

Fig.17   FFP PROGRAMMING FLOW CHART

```
┌─────────────────┐
│ FFP             │────── 17-1
│ PROGRAMMING     │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ IDENTIFY ALL THE│
│ PROTOCOL FIELDS │────── 17-2
│ OF INTEREST.    │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ DETERMINE PACKET│
│ TYPE AND FILTER │────── 17-3
│ CONDITIONS.     │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ CONSTRUCT FILTER│
│ MASK DEPENDING ON│───── 17-4
│ FILTER CONDITIONS│
│ AND PACKET TYPE.│
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ SELECT INCLUSIVE OR│
│ EXCLUSIVE FILTER  │──── 17-5
│ DEPENDING ON      │
│ PROBLEM TYPE.     │
└─────────────────┘
```

17-6 FILTER ON INGRESS PORT

17-7 FILTER ON EGRESS PORT

NO — NO

YES   YES

17-8 USE INGRESS PORT MASK

17-9 USE EGRESS MASK

17-10 CONSTRUCT RULES TABLE ENTRY.

17-11 INSERT THIS ENTRY INTO RULES TABLE.

AGE TIMER EXPIRED- >
START ARL AGING
PROCESS; START WITH
THE FIRST ARL ENTRY — 18-1

Fig.18

DOES
THE PORT BELONG TO
THIS ARL MODULE — 18-2

N   Y

IS THE
HIT BIT SET OR
IS A STATIC
ENTRY — 18-6

N   Y

18-7

DELETE THE ARL ENTRY.
SEND DELETE ARL ENTRY
TO OTHER MODULES,
INCLUDING CPU

RESET THE HIT
BIT IN THE ARL
ENTRY. — 18-8

IS THIS
THE LAST ENTRY
IN THE TABLE — 18-3

Y   N

START THE
AGE TIMER
-> DONE. — 18-4

GO TO THE
NEXT ARL
ENTRY. — 18-5

SW1

| 1 | 2 | 3 | – – – – – – – – – → | 26 |

A

T

SW2

| 1 | 2 | 3 | – – – – – – – – – → | 26 |

B

Fig.19

Fig.20

Fig.21

Fig.22

Fig.23

112-S

IS

DA (6B)	SA (6B)	VLAN TAG (4B)	STACK TAG (4B)	TYPE/LEN (2B)	DATA

Fig.24A

IS

STACK COUNT (5b)	SRC_T (1b)	SRC_TGID (3b)	SRC_RTAG (3b)	DST_T (1b)	DST_TGID (3b)	DST_RTAG (3b)	PFM (2b)	M (1b)	MD (1b)	Res (9)

Fig.24B

2000

SOC 10(1)

GIG
UPLINK

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

2001

INTERCONNECT
1-2 Gbps

SOC 10(2)

GIG
UPLINK

| 1 | 2 | 3 | | 25 | 26 |

2002

INTERCONNECT
1-2 Gbps

SOC 10(3)

GIG
UPLINK

| 1 | 2 | 3 | | 25 | 26 |

STATION B:
Src MAC=B; Dest MAC=A

2003

2004

SOC 10(4)

| 1 | 2 | 3 | | 25 | 26 |

Fig.25

2000

SOC 10(1)

GIG UPLINK

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

2001

INTERCONNECT
1-2 Gbps

GIG UPLINK

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

2002

INTERCONNECT
1-2 Gbps

GIG UPLINK

SOC 10(3)

| 1 | 2 | 3 | 4 | | 25 | 26 |

STATION B:
Src MAC=B

2004

2003

GIG UPLINK

INTERCONNECT
1-2 Gbps

SOC 10(4)

| 1 | 2 | 3 | | 25 | 26 |

Fig.26

Fig.27A

Port Number	Mac Address	Vlan ID	T	TGID	RTAG
1	A	1	0	X	X
26	B	1	1	2	2

Fig.27B

Port Number	Mac Address	Vlan ID	T	TGID	RTAG
26	A	1	0	X	X
26	B	1	1	2	2

Fig.27C

Port Number	Mac Address	Vlan ID	T	TGID	RTAG
26	A	1	0	X	X
1	B	1	1	2	2

Fig.27D

Port Number	Mac Address	Vlan ID	T	TGID	RTAG
26	A	1	0	X	X
26	B	1	1	2	2

GIG
UPLINK

SOC 10(1)

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

GIG
UPLINK

INTERCONNECT
1-2 Gbps

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

INTERCONNECT
1-2 Gbps

GIG
UPLINK

SOC 10(3)

| 1 | 2 | 3 | 4 | | 25 | 26 |

INTERCONNECT
1-2 Gbps

GIG
UPLINK

SOC 10(4)

STATION B:
Src MAC=B

| 1 | 2 | 3 | | 25 | 26 |

Fig.28

Fig.29

GIG PORT

FE PORTS

SOC 10(4)

LOCAL CPU   52(4)

2003

INTERCONNECT 1-2 Gbps

D

SOC 10(3)

LOCAL CPU   52(3)

INTERCONNECT 1-2 Gbps

2002

INTERCONNECT 1-2 Gbps

FE PORTS

SOC 10(2)

LOCAL CPU   52(2)

2004

INTERCONNECT 1-2 Gbps

2001

SOC 10(1)

CENTRAL CPU   52(1)

GIG PORT

2000

2100

SOC 10(1)

Gig
Uplink

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

2101

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

2102

SOC 10(3)

| 1 | 2 | 3 | | 25 | 26 |

STATION B:
Src MAC=B; Dest MAC=A

2103

SOC 10(4)

| 1 | 2 | 3 | | 25 | 26 |

GIG
UPLINK

Fig.30

2200

SOC 10(1)

Gig
Uplink

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

Interconnect
1-2 Gbps

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

Interconnect
1-2 Gbps

SOC 10(3)

| 1 | 2 | 3 | 4 | | 25 | 26 |

STATION B:
Src MAC=B

Interconnect
1-2 Gbps

SOC 10(4)

| 1 | 2 | 3 | | 25 | 26 |

Gig
Uplink

Fig.31

Fig.32A

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
1	A	1	0	X	X
25	B	1	1	2	2

Fig.32B

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	0	X	X
25	B	1	1	2	2

Fig.32C

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	0	X	X
1	B	1	1	2	2

Fig.32D

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	0	X	X

Gig
Uplink

SOC 10(1)

| 1 | 2 | 3 | | 25 | 26 |

STATION A:
Src MAC=A; Dest MAC=B

Interconnect
1-2 Gbps

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

Interconnect
1-2 Gbps

SOC 10(3)

| 1 | 2 | 3 | 4 | | 25 | 26 |

Interconnect
1-2 Gbps

SOC 10(4)

STATION B:
Src MAC=B

| 1 | 2 | 3 | 4 | | 25 | 26 |

Gig
Uplink
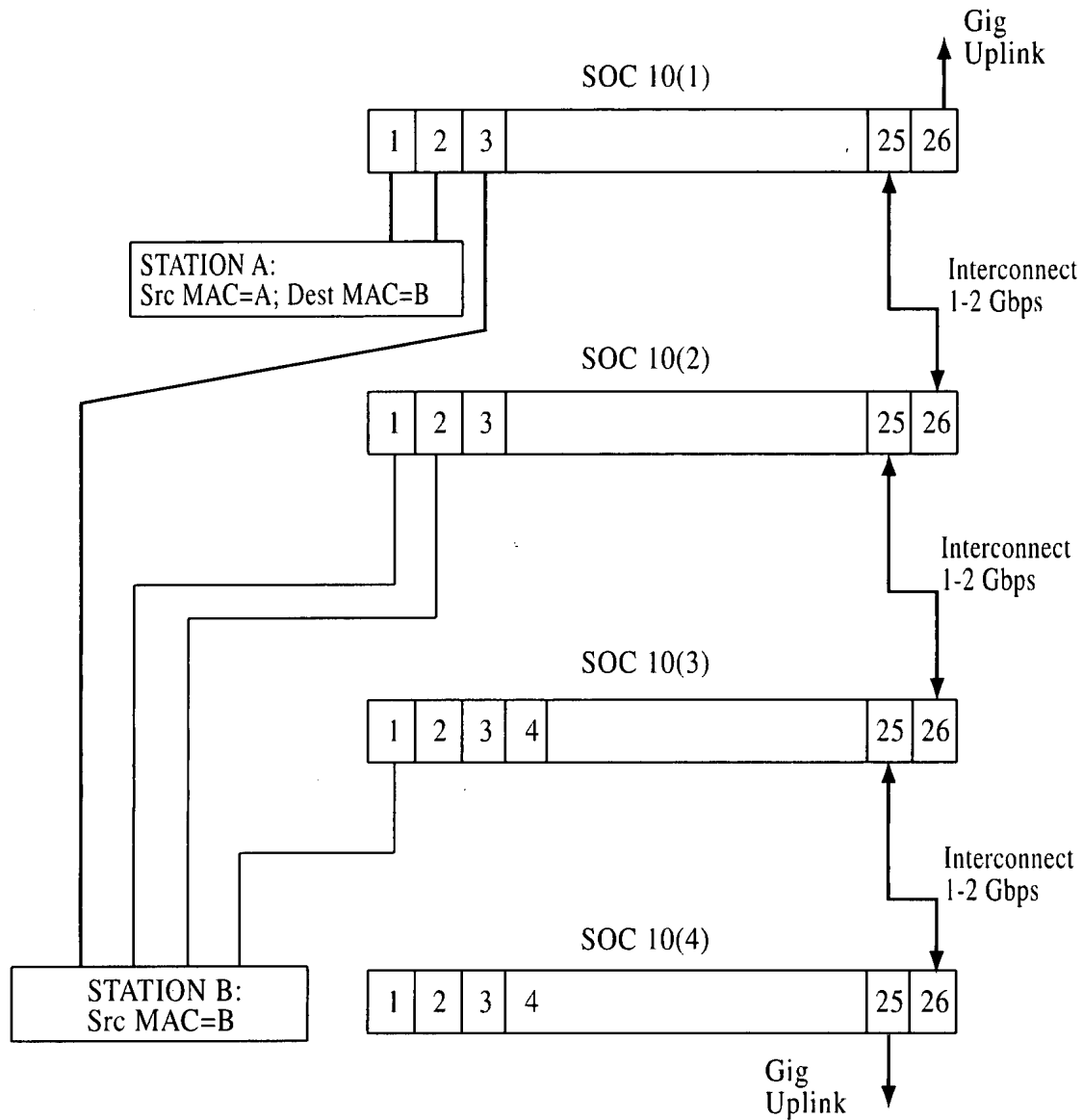
Fig.33

Fig.34A

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
1	A	1	1	1	1
25	B	1	1	2	2

Fig.34B

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	1	1	1
25	B	1	1	2	2

Fig.34C

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	1	1	1
1	B	1	1	2	2

Fig.34D

PORT NUMBER	MAC ADDRESS	VLAN ID	T	TGID	RTAG
26	A	1	1	1	1

VLAN Id=1

Gig
Uplink

SOC 10(1)

VLAN Id=1,3

| 1 | 2 | 3 | | 25 | 26 |

Interconnect
1-2 Gbps

STATION A:
Src MAC=A; Dest MAC=R1
SOURCE IP=A, Dest IP=B

SOC 10(2)

| 1 | 2 | 3 | | 25 | 26 |

Interconnect
1-2 Gbps

VLAN Id=3

SOC 10(3)

VLAN Id=1,3

| 1 | 2 | 3 | | 25 | 26 |

STATION B:
Src MAC=B

Gig
Uplink

SOC 10(4)

| 1 | 2 | 3 | | 25 | 26 |

Fig.35

Trunk Group Table for SW1:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
2	25	25	25	25	X	X	X	X	4

Trunk Group Table for SW2:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
2	25	25	25	25	X	X	X	X	4

Trunk Group Table for SW3:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
2	1	2	3	4	X	X	X	X	4

Trunk Group Table for SW4:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
2	26	26	26	26	X	X	X	X	4

Fig.36

Trunk Group Table for SW1:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
1	1	2	X	X	X	X	X	X	2
2	25	25	25	3	X	X	X	X	4

Trunk Group Table for SW2:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
1	26	26	X	X	X	X	X	X	2
2	25	1	2	26	X	X	X	X	4

Trunk Group Table for SW3:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
1	26	26	X	X	X	X	X	X	2
2	1	26	26	26	X	X	X	X	4

Trunk Group Table for SW4:

TGID	TP0	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TG Size
1	26	26	X	X	X	X	X	X	2
2	26	26	26	26	X	X	X	X	4

Fig.37
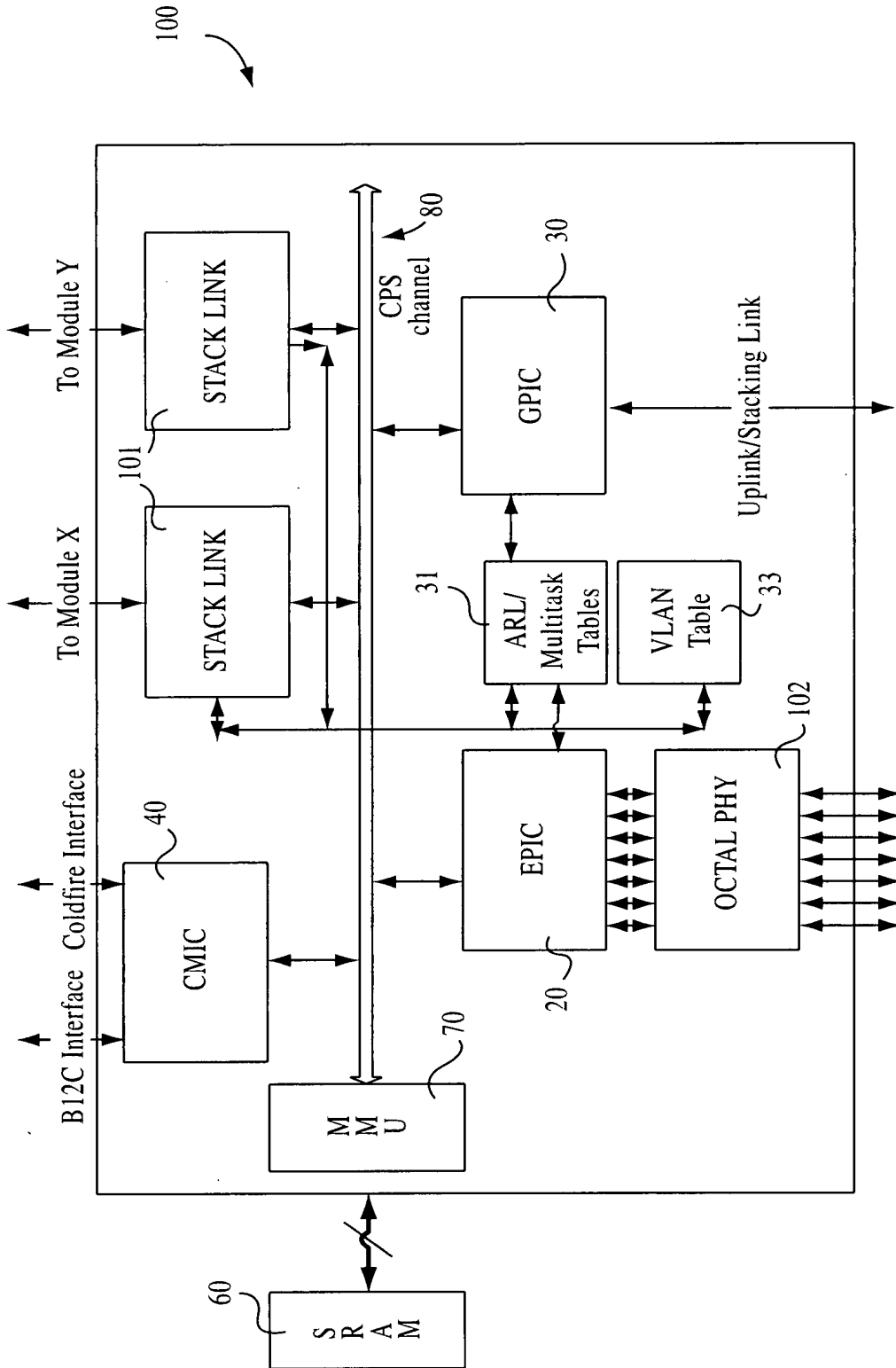
Fig.38

Fig.39

Fig.40

Fig.41

Fig.42

103

MODULE X   MODULE Y

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

MODULE Z

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |

A —   B

1 2 3 4 5 6 7 8 Gig 9 10 11 12 13 14 15 16 Gig   Gig 17 18 19 20 21 22 23 24
                       Uplink   Uplink Uplink
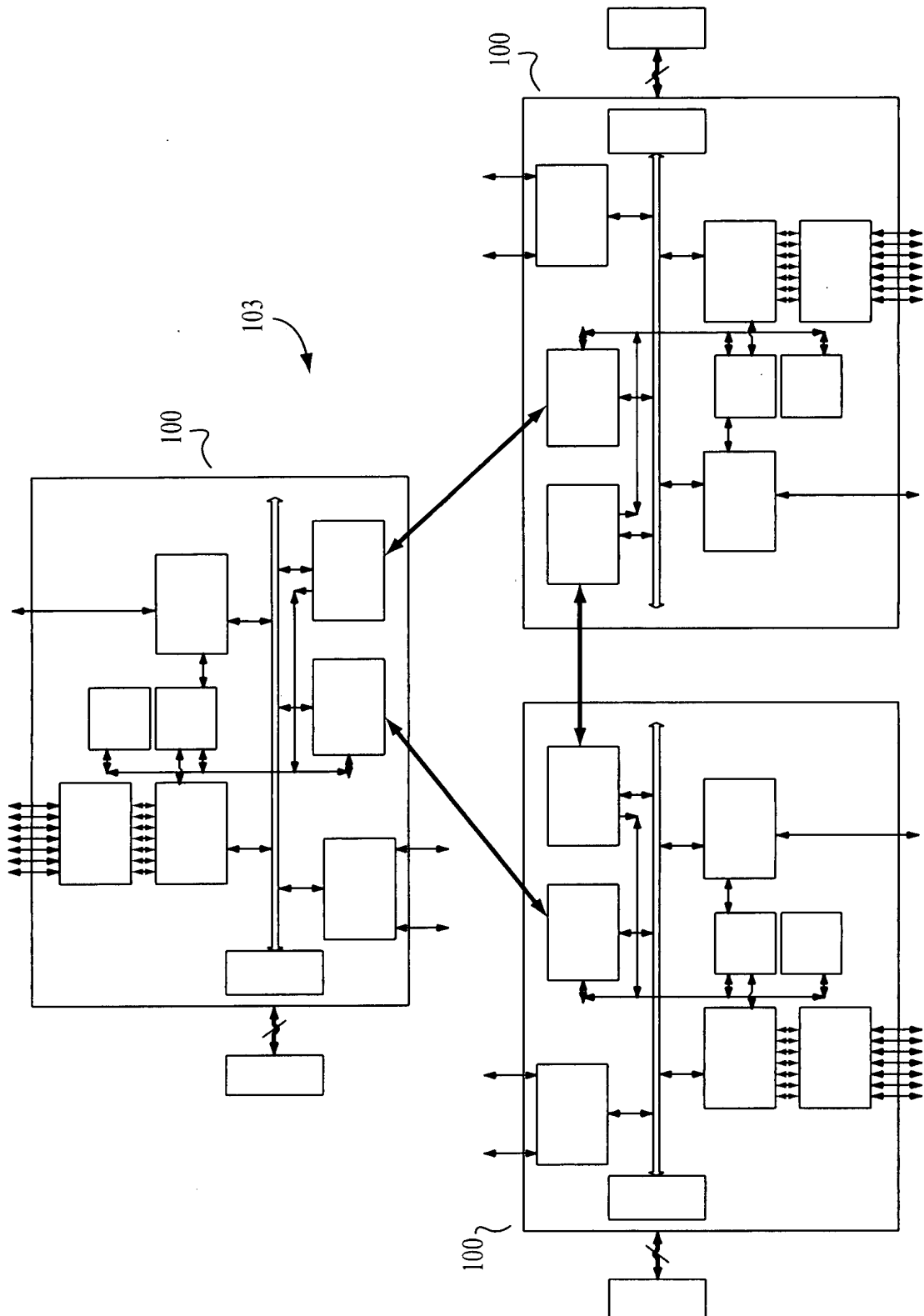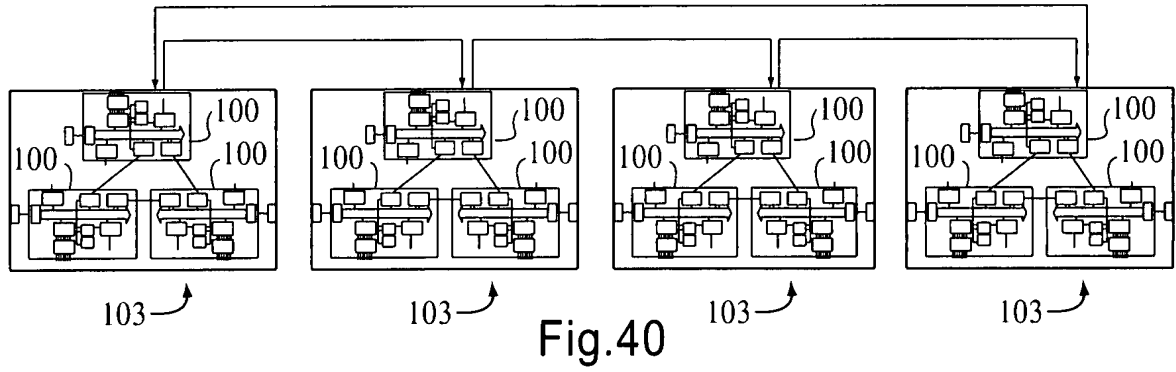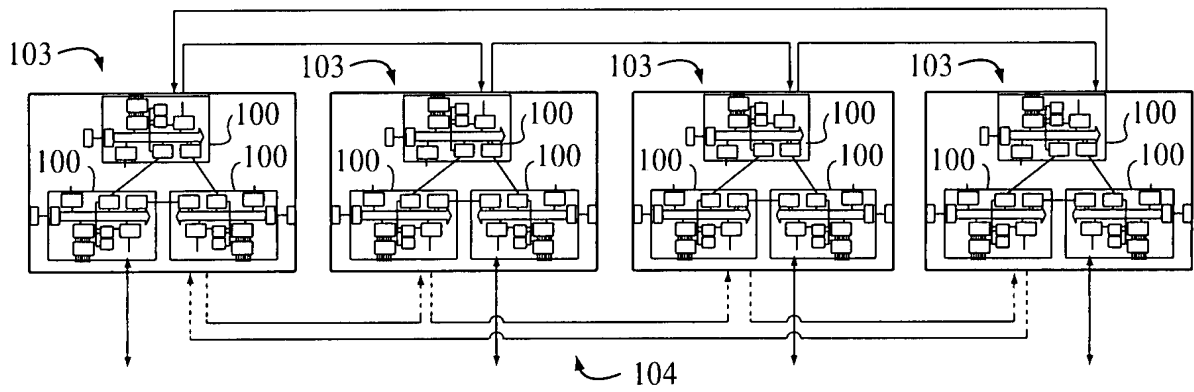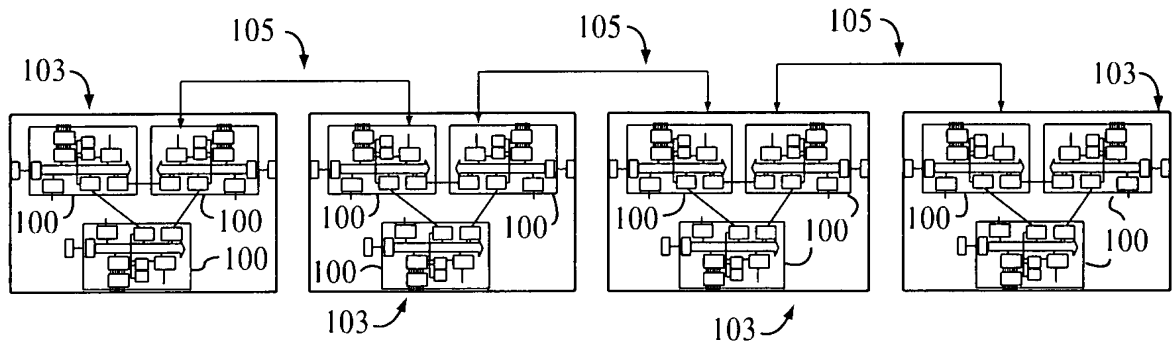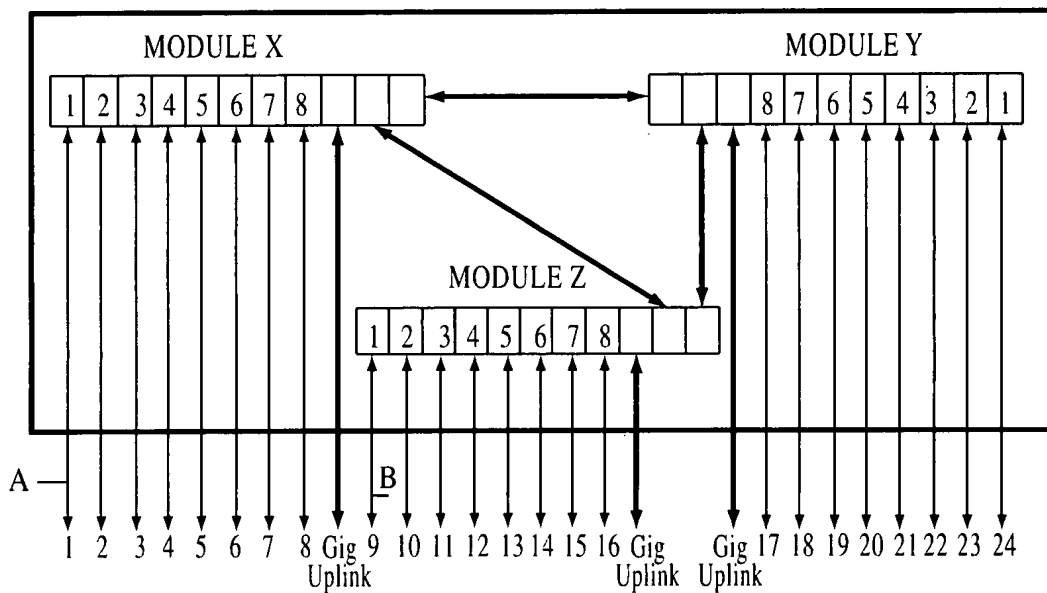
Fig.43

Table for Module X

Port Number	Mac Address	Vlan ID
1	A	1

TABLE A ←

Table for Module Y

Port Number	Mac Address	Vlan ID
G2	A	1

TABLE B ←

Table for Z

Port Number	Mac Address	Vlan ID
G2	A	1

TABLE C ←

Port Number	Mac Address	Vlan ID
G2	A	1
9	B	1

TABLE A

Port Number	Mac Address	Vlan ID
1	A	1
G2	B	1

TABLE B

Fig.44

43/43

Fig.45